# Texture-Less Planar Object Detection and Pose Estimation Using Depth-Assisted Rectification of Contours

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## ABSTRACT

This demo presents a method named Depth-Assisted Rectification of Contours (DARC) for detection and pose estimation of texture-less planar objects using RGB-D cameras. In the demonstration, the DARC method is used to perform real-time detection, pose estimation and augmentation of texture-less planar objects such as a logo, a traffic sign and a map. DARC's ability of discerning objects with the same shape but different sizes due to the use of depth data is also illustrated. In addition, the visitors are able to interactively register their own texture-less planar objects. More details on the DARC technique can be found in the poster session of the S&T track from this year's ISMAR.

**Keywords**: Pose estimation, texture-less objects, augmented reality, RGB-D cameras.

## 1 DEMO DESCRIPTION

*What makes it unique and special?* DARC is a technique for detection and pose estimation of texture-less planar objects, which are not handled by most existing object detection methods. It makes use of depth information available in consumer devices such as the Microsoft Kinect for obtaining a rectified representation of contours extracted from the RGB image. This normalized representation is invariant to rotation, scale and perspective distortions. It is obtained by transforming the contour points to a canonical view. Once the contours are rectified, they can be directly matched by computing their similarity using chamfer distance. This allows finding correspondences between contours extracted from a query image and previously obtained rectified contours from a single template image of each object, without needing to compute perspective warps from the reference images. Based on these correspondences, accurate pose estimation and augmentation of texture-less planar objects in real-time is possible, as shown in Figure 1. To the best of the authors' knowledge, there are no methods focusing 6DOF pose estimation of planar texture-less objects that make use of depth image.

*Why will it draw a crowd?* The visitors will be able to manipulate texture-less planar objects such as a logo, a traffic sign and a map and visualize their augmentation in real-time. Since DARC can handle targets distorted by rotation, scale and perspective transforms, the users will be able to move the objects over a large pose range. They will also see that the use of depth information allows DARC to distinguish objects that have the same shape but different sizes. When dealing with such targets, the virtual data will be rendered with a different color and size depending on the size of the detected object. Detection methods that are based solely on RGB data are not able to differentiate, for example, between a small object at a close distance and a big object at a far distance when their projections have the same shape and size. Finally, the visitors will have the opportunity of registering their own texture-less planar objects in an interactive way. Once the targets are registered, they can be detected and augmented.

*Would an AR expert want to see it and why?* The DARC method is an initiative of using low cost RGB-D consumer devices for texture-less planar object detection and pose estimation[1]. It requires only a single RGB-D image of the planar object in order to estimate its pose, opposed to some existing approaches that need to capture a number of views of the target object. It also does not generate warped versions of the templates, which is commonly required by existing object detection techniques. The DARC method runs in real-time and its detection and pose estimation quality are suitable for AR applications.

Figure 1: Augmentation of the ISMAR logo using the DARC method. The highlighted contour is rectified with the aid of depth data, allowing its detection and pose estimation.

## 2 DEMONSTRATION SPACE INFORMATION

- *Amount of desktop space needed*
  - Desktop measuring 0.75m x 0.75m.
- *List of equipment to be brought*
  - Laptop;
  - Microsoft Kinect;
  - Laptop AC adapter;
  - Microsoft Kinect AC adapter;
  - Mouse.
- *Power, socket and outlet needs*
  - Two power outlets.
- *Networking requirements*
  - None.
- *Environment requirements*
  - Well-lit environment.

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[1] URL of the demo video: http://goo.gl/PmXzQ